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It is often much cooler at Charleston, Key West, and elsewhere at the South than it is at Baltimore or New York in these cases of excessive heat. And a whole month, as well as a shorter period may exhibit such comparatively cool weather at the points from which it might be inferred that the heat would be transferred to us. In fact, at Charleston and Savannah, the intense heat of the last summer at New York and the North were unknown!—a mean of 85° at the North being reduced there to a mean of $81\frac{1}{2}^{\circ}$ only.

5. These more striking non-periodic extremes, both of heat and cold, appear to be instituted at the districts where they are felt, by or through some superior and extraneous agency, the elements of which are at present extremely difficult of determination.

I beg for the present merely to submit these propositions, as being indicated only, not proved, although much time and observation have been given by me to the consideration of the subject. I shall beg also to submit at an early day, the numerical elements of the investigation as so far conducted.

OSCILLATORY FORCES IN THE SOLAR SYSTEM.

BY PLINY EARLE CHASE, PROFESSOR OF PHYSICS IN HAVERFORD COLLEGE.

(*Read before the American Philosophical Society, February 7th, 1873.*)

All material motion seems to be determined by tendencies to equilibrium between elastic, or centrifugal, and attractive, or centripetal forces. It may, therefore, be presumed that every molecular motion can be so connected by simple equations, with solar force, as to furnish an almost endless variety of methods for estimating the Sun's mass and distance.

The solar radiating forces (luminiferous, caloriferous, etc.), are supposed to move with uniform velocities in straight lines. Gravitating motion is uniform only in circular orbits. We may, therefore, reasonably look for the circular ratio, π , among the conditions of planetary equilibrium. The influence of that ratio in positing alternate planetary orbits, is shown in the following table, each of the theoretical terms being obtained by dividing the preceding term by π .

CARDINAL POSITIONS IN THE SOLAR SYSTEM.

	Theoretical.	Observed.
Neptune, mean.....	30.04*	30.04
Saturn, ".....	9.56	9.54
Mars, major axis.....	3.04	3.05
Earth, perihelion.....	.97	.98
Mercury, ".....	.31	.31

* $\frac{\pi^6}{32}$. If π^n represents the time of revolution in a circular orbit, $\pi^n \div \sqrt{32}$ represents the time of fall from the circumference to the centre.

The intermediate planets are arranged at distances proportioned to orbital times at reciprocal centres of oscillation and suspension. Jupiter's mean distance is nearly $3^{\frac{3}{2}} \times$ Earth's; that of Uranus, $(3^{\frac{3}{2}})_2 \times$ that of Venus.

INTERMEDIATE PLANETARY POSITIONS.

	Theoretical.	Observed.
Uranus.....	19.30*	19.19
Jupiter.....	5.20	5.20
Venus.....	.72	.72

The aphelion distances of Neptune, Uranus and Saturn, are at one extremity and centres of oscillation of a simple pendulum. The distance of Uranus, or the mean length of the pendulum, represents the length of a light undulation which is synchronous with a planetary oscillation at the Sun's surface. Jupiter's perihelion distance is one-sixth of Neptune's. The significance of this coincidence is the more interesting, in view of Stockwell's discovery that the mean perihelion longitudes of Jupiter and Uranus differ by exactly 180° , and, therefore, Jupiter's perihelion is properly comparable with the aphelion of Uranus.

The following table shows the accordance of these relations.

NODAL POINTS OF PLANETARY OSCILLATION.

	Theoretical.	Observed.
Neptune, mean aphelion.....	30.38	30.30
Uranus, " "	20.26	20.05
Saturn, " "	10.13	9.94
Light, Undulation.....	20.26	20.20
Jupiter, mean perihelion.....	4.96	4.98

The principal planetary masses are so placed as to exhibit simple relations between their orbital moments of inertia. The mean moments of Jupiter and Saturn are nearly equal; Neptune's is about π times as great as that of Uranus; the sum of the moments of Venus and Mars is about two-thirds as great as that of Earth and Mercury; the centre of inertia of the planetary system is within the orbit of Saturn.

PLANETARY INERTIA.

Jupiter, mean moment.....	258,200
Saturn, " "	259,627
Uranus, " " $\times \pi$	482,378
Neptune, " "	480,439
$\frac{2}{3}$ (Earth + Mercury).....	21.5
Venus + Mars.....	20.8
Mean centre of inertia.....	9.35
Mean distance of Saturn.....	9.54

* .955 $\times$ 20.20. See next table.